Topic/Objective:	Name: Hannah Daley
Clouds	Class/Period: AOSC200
	Date: 10/8/19

Essential Question:

Name and Describe the 4 lifting mechanisms? How do we know if the atmosphere is stable or unstable? What does that mean? What are clouds and contrails?

Questions:	**Notes:**
What are the 4 lifting mechanisms? This will almost certainly be a question	1. Orographic or Mountain lifting a. When a physical barrier forces air coming towards it to be forced upward. 2. Convergence a. When air is forced inward at a point, so air at the point has no where to go but up. 3. Frontal Lifting a. Remember cold air sinks and warm air rises so when warm and cold air meet (like at the edge of a frontal system) the warmer air will rise/lift i. Cold front: acts like a bull dozer that rapidly throw the warm air up. You see clouds with a lot of vertical motion (cumulus) ii. Warm front: warm are slides over the cooler air below. This is a slower process and likely results in cloud “deck” or sheet like clouds (stratus) 4. Convection: a. If the surface gets very hot it will heat the air directly above it (conduction). That hot air will rise (convection) b. Convective storms typically occur in the afternoon because it is the <u>hottest time of the day</u>
What does it mean to say that the atmosphere is stable or unstable?	● Stable atmosphere: means that the air will not rise unless something forces it up like a mountain. - Air needs to be lifted for a clouds (thus storms) to happen, so it is intuitive that a stable atmosphere is likely going to have stable weather conditions - The Dry, Adiabatic lapse rate is 10 C/km - If the Environmental Lapse rate is <u>less</u> than the Adiabatic Lapse rate the atmosphere is stable and warm air parcel will not rise unless forced up to a height so that the environmental lapse rate is greater than the adiabatic lapse rate - Note: lapse rate is the rate the temperature <u>declines</u> with altitude. AND the initial parcel has to be warmer than the environment for this

<table>
<tr><td></td><td>to start
● Unstable atmosphere: the air can rise on its own through convection
○ If the Environmental Lapse rate is Greater than the Adiabatic Lapse rate (10 C/km) the atmosphere is unstable and warm air parcel will rise
○ Note: lapse rate is the rate the temperature declines with altitude. AND the initial parcel has to be warmer than the environment for this to start
● Conditionally Unstable: if the air is initially lifted then it will continue to rise up, but it will not rise unless it is lifted a bit first</td></tr>
<tr><td>Clouds! The basics you need to pass an AOSC200 exam</td><td>Know what these root/ suffix/ prefix words mean:

<table><tr><th>root/ suffix/ prefix</th><th>Height in atmosphere</th><th>Structure</th></tr><tr><td>Cirrus/ Cirro</td><td>High</td><td>thin/ wispy</td></tr><tr><td>Alto</td><td>Mid-level</td><td></td></tr><tr><td>Stratos/ strato* (most confusing)</td><td>means low level</td><td>And/or it means “deck-like”</td></tr><tr><td>Cumulus</td><td>“Cumul”ating height</td><td>Thick/ vertical development</td></tr><tr><td>Nimbo/Nimbus</td><td></td><td>Precipitation is occuring</td></tr></table>
Tim’s Top 4 favorite clouds to put on exams (dont worry, we go easy on spelling):
● Cumulonimbus: cumul (vertical development/thick)+nimbus (rain)= thick thunderstorm clouds
● Nimbostratus: Nimbo (Precipitation)+stratus (low level/ deck-like) = a large sheetlike layer of rain clouds, often associated with a warm front
● Cumulus or fair weather cumulus: cumulus (vertical development/thick)= isolated puffy clouds with no rain
● Cirrus: High in the sky and thin</td></tr>
<tr><td>What are contrails and what does it mean to have long or short lasting contrails?</td><td>● Contrails are cloud trails behind planes in the sky
● Why does this happen? Through fuel combustion, plane exhaust systems release hot water vapor. Upon leaving the aircraft into a colder environment the vapor will condense and these droplets make up a cloud (contrail)
● Why do some contrails last for a long time? If the contrail is very long and lasts a while this is because the cloud/contrail that we just formed is in a moist environment. The vapor doesn’t evaporate out as quickly.
● If the contrail is short-lived, then this tells us that the plane is flying into a very dry region, so the cloud/contrail will evaporate quickly
● COMMON MISTAKE: On a previous exam many students said that the contrails were short because the environment was too hot or it was long-lived because it was cold out. This is not a practical argument because this temperature effect will be relatively small.</td></tr>
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Summary
The four main lifting mechanisms are convection, convergence, orographic/mountain, and frontal. Students should be able to name and describe all kinds of lifting mechanisms. When warm moist air is lifted the air will cool and the vapour will condense and form clouds. This lifting occurs in unstable environments and will only form in stable environments if the air parcel is constantly forced up. Students should know the difference between cumulonimbus, nimbostratus, cumulus and cirrus clouds. Contrails are not chemtrails and the length that they last in the sky is dependent on how moist the environment is.